

Scientific Aptitude as a Predictor of Achievement in Science: A Study of Economically Disadvantaged Students

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ABSTRACT

The present study was conducted to explore the differential levels of scientific aptitude among the economically disadvantaged students of Jammu and Kashmir. The objectives of the study were to find out the achievement in the subject science of economically disadvantaged secondary school students and the levels of scientific aptitude of economically disadvantaged secondary school students. The study also aims to compare the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude and the achievement in science of economically disadvantaged secondary school boys and girls having differential levels of scientific aptitude. As such, the study involved purposive sampling and 200 10th standard students of Anantnag district of Jammu & Kashmir. The data were collected with the help of a standardized tool prepared by Dr. Nagappa P. Shahapur and Dr. C. R. Rao in 1971. The study revealed that academic achievement of secondary school students, the boys and that of girls of Anantnag district of Jammu and Kashmir belonging to differential levels of scientific aptitude differ significantly.

Keywords: Scientific Aptitude, Academic Achievement, Secondary School Students, Economically Disadvantaged students.

The 21st century is the age of science, innovation, and technology. So, students living in this century must possess knowledge and skills of science and technology. The use of technological tools makes teaching and learning more effective (Kouser & Majid, 2021). For this purpose, scientific aptitude is needed among the students. Scientific aptitude is the capability or ability of a person, innate or acquired to do something in the scientific field. When scientific aptitude comes in the students, then the achievement in science becomes easier, and finally, scientific achievement gets ensured. The results of many types of research like (Bhaskara 1995, Jose 1987 etc.) reported that there is a positive relationship between scientific aptitude and achievement in science. Science is not limited to a few seriously devoted persons. Since, life in the present world perpetually warrants, to variable degrees, knowledge of scientific facts and laws, science has now become everyday science for everybody. In addition, science inculcates certain special values such as aesthetic, cultural, intellectual, moral, utilitarian as well as vocational values peculiar to it, which no

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other subject can provide. Science learning provides training in scientific method and also helps to develop a scientific attitude of mind among the learners. The qualities imbibed or inculcated by the learner through learning science are of great value to a citizen living in the Society. Scientific methods must be applied with greater vigor and imagination to the behavioral aspects of our culture. The development of the behavioral sciences and their application to education and other human affairs present some of our greatest challenges.

Scientific Aptitude, Academic Achievement and Achievement in Science

The word aptitude is derived from the Latin word “aptos” which means “joined or fitted for”. Aptitude is the ability or skill to succeed in a specific field of activity. It is a present condition that is revealing of an individual's potentialities for the future. Aptitude is equal to capacity plus interest. In short, aptitudes are latent potentialities or undeveloped capacities to acquire abilities and skills and to demonstrate achievements. It is an intellectual phenomenon and is integrated part of personality. It is present condition with a forward reference. It is fairly stable but not perfectly constant. Aptitude is a contribution of both heredity and environment. Aptitude denotes the expectation about the individual's future performance. Individual differences can be seen in aptitudes. Aptitude does not involve the organization of concepts, beliefs, habits and motives. Aptitudes are more stable than attitudes. It always has an innate basis. It is always specific. Aptitudes never reverse completely within in life span of an individual. Aptitudes once established, seldom change. Aptitudes are formed only up to puberty.

Academic achievement is the basic or fundamental unit of the entire educational system. It is regarded as an important goal or target of an education system. Academic achievement is the outcome or result of the instruction provided to the children in schools, which determine their grades or marks secured or obtained by the students in the examination. Aptitude generally shows the learning outcomes of pupils which requires a series of planned and organized experiences. Academic achievement is the main and permanent responsibility of a school or any other educational institution established by the society to promote whole academic growth and development of a child.

Achievement refers to the scholastic achievement of the pupils at the end of an educational programme or the competence they actually show in the school subjects in which they have received instruction. Achievement is the performance or acquired proficiency in the performance of an individual with respect to a given knowledge or skill. Scientific achievement means something accomplished, especially by superior ability, special effort and great courage in the field of science. Thus, achievement is the sparkling crown, which reflects a sense of genuineness, truthfulness and persistence on the part of the achievers.

Scientific Aptitude as Predictor of Academic Achievement

Scientific aptitude is concerned with the ability of future achievement in science. If an individual is gifted with better scientific aptitude, he or she can climb the ladder of science with ease and effect. In India, systematic and sustained research work is lacking in the field of aptitude testing in general and measurement of scientific aptitude particular (Sharma, 1980). Nevertheless, after the recommendations of Secondary Education Commission (1956) were adopted, interest in aptitude testing grew and some independent attempts were made to standardize scientific aptitude tests and to study scientific aptitude of school children. We are living in a society which is completely drawn into the scientific environment. Science has become a vital part of our life and living. Now, we cannot think of

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the world without science. The wonderful achievements of science have reverence the modern world and transformed or changed the modern civilization into scientific civilization.

Economically Disadvantaged Students of J&K

In Jammu & Kashmir, Scheduled Caste, Scheduled Tribe and Weak classes constitute a special group of disadvantaged community, which are extremely poor. In order to maintain their livelihood, all the family members including young children have to undertake some economic activity, which makes some income for them. Therefore, if children are sent to school, the parents have to forgo the income they bring or help they receive from them in their economic activities. They are so poor that they cannot bear even this small loss. Besides, though the children get free education, the parents have to incur at least some expenditure for sending them to school. Because of all these factors, they generally develop an attitude of not sending them to school. Thus, family's economic condition develops negative attitude towards education of the children belonging to all disadvantaged sections and they are deprived of schooling and education.

Scientific Aptitude of Economically Disadvantaged Students of J&K

The economically disadvantaged children have learning difficulties. They show lack of interest, involvement in academic success. They do not participate in classroom discussions which results in lack of confidence and competence in expressing themselves. They show specific learning difficulties in different subjects. Consequently, failure, repetition of grade and premature termination occur among these children. These children mostly receive an ignored and indifferent attitude from their parents or guardians. They remained almost unheard, un-replied and uncared. These children are always on the lookout for someone to whom they should love and by whom they should be loved and looked after. The economically disadvantaged students of Jammu and Kashmir suffer a lot of hardships, hurdles and miseries as compared to other general students. Their income is very low which affects their education also. Due to their poorness some economically disadvantaged students withdraw their education and those who are reading generally possess low scientific aptitude.

Academic Achievement of Economically Disadvantaged Students of J&K

Academic achievement plays an important role in fulfilling the development of the child. The expectation of academic achievement has assumed enormous importance to its practical view. In our society, academic achievement is considered as a important criterion to judge one's total potentialities and capacities. It forms the main basis of admission and promotion in a class. It is also important for obtaining a degree or getting a job. The economically disadvantaged students of Jammu and Kashmir suffer a lot of hardships, hurdles and miseries as compared to other general students. Their income is very low which affects their education also. Due to their poor-ness some economically disadvantaged students withdraw their education and those who are reading generally possess low academic achievement as well as low scientific aptitude.

Rationale of the study

Science plays a major role in cultivating hope for continuous and progressive welfare. The strength of a modern economy depends on the strengths of its industry and industrial development. It depends upon technology and on the application of new scientific knowledge. At the same time, the nation's progress, prosperity and success also depend on a

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quick, strategic and continued growth in the quality and extent of education and research in science and technology (Kothari Commission (1964-1966)). Science in curriculum provides certain values which are not provided by any other subject. It affords knowledge of certain facts and laws and an insight into methods and data peculiar to the domain of science. In India, approximately seven million students appear for the secondary examination every year, and more than three million of them are from the science stream. Enrolment in Science group has risen steadily over the years. It is an emerging trend that young students select science stream because of the subject's potentialities for job opportunities. Science is playing a major role in the present age to satisfy the needs and desires of the people, and it has also influenced the major human activities. So, after the higher secondary stage, students undertake and feel that science is a meagre collection of information. Rote memorization of scientific facts lacking of meaningful understanding of its influences negatively on the thinking capacities of the learners. Knowledge of the level of scientific aptitude held by student population will be helpful in planning science education according to the level of students. Individuals having high scientific aptitude are needed for the modern Indian society. By identifying the effect of scientific aptitude on achievement in the science of secondary school students helps to get a prediction about the future of the country. Further the study of science requires some financial requirements which the students are expected to possess. In studying science subjects, financial requirements are needed more as compared to arts subjects. Poor financial status adversely affects the study in general and that of the study of science in particular. Also, most of the studies are on scientific aptitude and achievement in science but the very few or almost negligible studies are on economically dis-advantaged categories which is supposed to affect the study in general and study of science in particular, so the investigator has felt need of it to conduct research on that problem. In this context, the investigator of the study thought to conduct the study on the achievement in science of economically disadvantaged secondary school students of Anantnag district of Jammu and Kashmir which is a backward district having differential levels of scientific aptitude.

Objectives

- To compare the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude.
- To compare the achievement in science of economically disadvantaged secondary school boys having differential levels of scientific aptitude.
- To compare the achievement in science of economically disadvantaged secondary school girls having differential levels of scientific aptitude.

Hypotheses

The hypotheses of the study are as follows:

- H_{01} The achievement of economically disadvantaged secondary school students in science belonging to differential levels of scientific aptitude do not differ significantly.
- H_{02} The achievement of economically disadvantaged secondary school boys in science belonging to differential levels of scientific aptitude do not differ significantly.
- H_{03} The achievement of economically disadvantaged secondary school girls in science belonging to differential levels of scientific aptitude do not differ significantly.

MATERIALS AND METHODS

In the present study, the researcher used the descriptive method of research. A sample of 200 economically disadvantaged secondary students were taken as the sample of the study. Out of those 200 economically disadvantaged secondary school students, 100 were boys and 100 were girls. The parents those have been issued BPL card by the state government are considered to be as the people belonging to economically disadvantaged group. Hence the children belonging to such parents reading in class 10th were taken purposively as the sample of the study. In this context, the investigator followed the purposive sampling technique of non-probability sampling method for determining the sample for the study. The investigator took a sample of 200 class 10th students from four different schools of the Anantnag district.

RESULTS AND DISCUSSION

The obtained results have been analyzed and interpreted with reference to the objectives and hypotheses stated earlier. The major objective of the study was to find out of the achievement in the subject science of economically disadvantaged secondary school students with reference to the levels of scientific aptitude of economically disadvantaged secondary school students, hence the study aimed to compare the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude and the achievement in science of economically disadvantaged secondary school boys and girls having differential levels of scientific aptitude. As a first step of analysis the students have been classified into three levels that is high, moderate and low on the basis of differential levels of scientific aptitude and achievement in science of economically disadvantaged secondary school students in general and that of boys and girls were subjected to the testing of student's significance of mean differences through one way analysis of variance.

Table 1.1 Level of Scientific Aptitude of Economically Disadvantaged Secondary.

Category (BPL)	Mean	SD	Levels	Score	N
Total 200	41.92	17.011	High ($M+1\sigma$)	59 & Above	38
			Moderate ($M \pm 1\sigma$)	26-58	114
			Low ($M-1\sigma$)	25 & Below	48
Boys 100	40.77	19.35	High ($M+1\sigma$)	60 & Above	27
			Moderate ($M \pm 1\sigma$)	22-59	43
			Low ($M-1\sigma$)	21 & Below	30
Girls 100	43.07	14.20	High ($M+1\sigma$)	57 & Above	11
			Moderate ($M \pm 1\sigma$)	30-56	71
			Low ($M-1\sigma$)	29 & Below	18

Table 1.1 reveals that it is clear that in case of the total sample of 200 secondary school students; the students scoring 59 and above, scoring 26-58 and 25 or below comes under the high, moderate and low level of scientific aptitude. On the other hand, in case of the boys the students scoring 60 and above, 22 to 59 and 21 and below are taken as high, moderate and low respectively, where as in case of the girl sample the students scoring 57 and above, 30-56 and 29 and below are considered as high, moderate and low respectively. The table 1.1 reveals that the students (boys & girls) have mean value of 41.92 and standard deviation value of 17.011 on scientific aptitude whereas the boys have mean score of 40.77 and standard deviation of 19.35 and girls have a mean score of 43.07 and standard deviation of

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14.20. Such value indicates that the girls have high aptitude as compared to boys. The findings of the present study are supported by the studies of Bhaskara (1995), Seashore (1962), Gosh (1986), Sharma (1984), Raza and Shah (2011), Sekhri (2016) and Gogoi and Munda (2016).

Table No. 1.2 Significance of difference in the academic achievement of secondary school Economically Disadvantaged Students in science having differential levels of scientific aptitude

Source of variation	Sum of squares	Df	Mean square (Variance)	F- ratio
Between Sets	11867	2	5933.5	10.64**
Within Sets	109847.23	197	557.60	
Total	121714.23	199		

**Sig. at 0.01 Level

An analysis of the table No.1.2 reveals the F- value as 10.64 which is greater than the table value of F at 0.01 level of significance, therefore, the result is significant. Hence H_{01} is rejected and it can be inferred that there exists significant difference in the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude that is high, moderate and low. In other words we can say that the secondary school students having differential levels of scientific aptitude differ in their achievement in science.

Table No. 1.3 Significance of difference in the academic achievement of secondary school Economically Disadvantaged Boys in science having differential levels of scientific aptitude

Source of variation	Sum of squares	Df	Mean square (Variance)	F- ratio	Remarks
Between Sets	5754	2	2877	3.13	Not significant
Within Sets	88881.67	97	916.30587		
Total	94635.37	99			

An analysis of the table No.1.3 reveals the F- value as 3.13 which is less than the table value of F at 0.01 level of significance, therefore, the result is not significant. Hence H_{02} is accepted and it can be inferred that there exists no significant difference in the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude that is high, moderate and low. In other words we can say that the secondary school students having differential levels of scientific aptitude do not differ in their achievement in science. The findings of the present study are supported by the Sharma (1980), Jose (1987), Nataraj and Manjula (2012), Mukhopadhyay (2013) and Panneerse Iyam and Muthamizhselvan (2015).

An analysis of the table No.1.4 reveals the F- value as 22.44 which is greater than the table value of F at 0.01 level of significance, therefore, the result is significant. Hence H_{03} is rejected, and it can be inferred that there exists significant difference in the achievement in science of economically disadvantaged secondary school students having differential levels of scientific aptitude that is high, moderate and low. In other words, we can say that the

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secondary school girls having differential levels of scientific aptitude differ in their achievement in science

Table No. 1.4 Significance of differences in the academic achievement of secondary school Economically Disadvantaged Girls in science having differential levels of scientific aptitude

Source of variation	Sum of squares	Df	Mean square (Variance)	F- ratio
Between Sets	6158	2	3079	22.44**
Within Sets	13308.38	97	137.19	
Total	19466.38	99		

**Sig. at 0.01 Level

Major findings of the Study

The study of scientific aptitude of secondary school students will help the teachers to know the interest and inclination of students towards science and accordingly they can try to inculcate the same among the students. The teachers as well as the administrators will be able to know the achievement levels of economically poor category of students belonging to differential levels of scientific aptitude and accordingly steps can be taken if necessary to ensure the better financial status of such category of children as well as their academic achievement. Scientific aptitude, the predictor of future performance, may be developed to greater extent if found unusual among the economically disadvantaged secondary school students. The results of many researches prove that there is a positive relationship between Scientific Aptitude and Achievement in Science, students can be trained in scientific aptitude to get more achievements in their science subjects.

CONCLUSIONS

On the basis of careful analysis and interpretation of the objectives and hypotheses of the study it can be concluded that;

- Secondary school students having differential levels of scientific aptitude differ in their achievement in science.
- Secondary school boys having differential levels of scientific aptitude do not differ in their achievement in science.
- Secondary school girls having differential levels of scientific aptitude differ in their achievement in science.
- Scientific aptitude of girls was found to be higher than the scientific aptitude of boys.

Delimitations

The study is delimited to Secondary School Students of Jammu and Kashmir.

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Conflict of Interest

The author(s) declared no conflict of interest.

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